

Remarks/Arguments:

Claims 1-10 were pending in this application. With the amendment, applicants are amending claims 1 and 9. Claim 8 was previously cancelled. Therefore, claims 1-7, 9, and 10 are now pending in the present application.

The Examiner has kindly noted that a drawing was not included in the application. The specification has been amended to omit the references to a drawing, which is not essential for understanding the invention. The aspects intended to be conveyed in the drawing are adequately conveyed by the text of the application.

Claim 8 stands rejected to based upon 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out what is included or excluded by the claim language. This claim was previously cancelled in the Preliminary Amendment dated February 28, 2001. A copy of the Notification of Acceptance of Application, identifying receipt of the Preliminary Amendment, is attached for the Examiner's convenience.

Claims 1-5, 8-10 stand rejected under 35 U.S.C. § 102(e) as being clearly anticipated by Wallach (U.S. Patent No. 6,495,368 B1) as evidenced by <http://allergies.about.com>. Claims 1-3, 6-8 stand rejected to under 35 U.S.C. § 102(b) as being clearly anticipated by Frei et al (1973) as evidenced by <http://allergies.about.com>. Claims 1-6, 8-10 are rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Kannakkanat (U.S. Patent No. 5,501,945). Claims 1, 2, 4, 5, and 9 stand rejected under 35 U.S.C. § 102(b) as being clearly anticipated by Honeybourne (WO 9315403). It is respectfully submitted that the claims, as amended, are patentable over the art of record for the reasons set for below.

The applicants' invention, as recited by amended claim 1, includes features which are neither disclosed nor suggested by the art of record. For example, claim 1 recites "a metal co-ordinated complex immobilised in or on a substrate." Claim 1 also recites, that the "complex, upon food spoilage or the opening or the compromise of packaging, undergoes a ligand exchange reaction to release a detectable component by preferential binding of a gaseous substance to the metal of said complex." Claim 9 similarly recites the step of "inserting into or applying to said package or incorporating into a portion of the interior surface of said package, a metal co-ordinated complex immobilised in or on a substrate." Claim 9 also similarly recites, that the "complex, upon food spoilage or the opening or the compromise of

packaging, undergoes a ligand exchange reaction to release a detectable component by preferential binding of a gaseous substance to the metal of said complex."

This means that the metal complex undergoes a chemical reaction in which a ligand, such as fluorexon, complexed with a metal, such as palladium, undergoes a ligand exchange with another ligand such as sulphur compounds (e.g. sulphides) or nitrogen compounds (e.g. amines), present in spoiled foods in the gaseous phase, thus releasing a detectable component, such as a fluorexon. This released component is used to detect the food spoilage. This feature has advantages over current methods in that it enables the present invention to be suitable for use directly in the package, allowing continuous monitoring of food quality from packaging to consumption. The claimed invention overcomes the disadvantages of long evaluation times and sample destruction in currently used methods.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." See MPEP § 2131. With regard to the rejection based on Wallach, claim 1 was rejected based on the reason set forth in the Office Action that Wallach teaches Calcein, which is synonymous with fluorexon, as evidenced by <http://allergies.about.com>. The applicants' invention, as recited by amended claim 1, however, includes features which are neither disclosed nor suggested by Wallach. Claims 1 and 9 require a metal co-ordinated complex which undergoes a ligand exchange reaction, releasing a detectable component. Wallach does not disclose the use of metal co-ordinated complexes, but rather the use of a pH sensitive dye, such as Calcein, used on its own as the spoilage indicator device. The Wallach invention relies upon a reaction whereby fluorexon can protonate or deprotonate its hydroxy group under conditions of varying pH. This reaction gives rise to the color change disclosed in Wallach.

The claimed invention utilizes a complex of fluorexon with a metal, such as palladium, which is co-ordinated via the oxygen atoms of the nitrogen bound terminal acid groups. This oxygen to metal coordination forms a relatively weak bond. Thus, in the presence of sulphur, nitrogen, or phosphorous compounds, strong bonds form with metals, such as palladium, thereby easily displacing the fluorexon ligand. As a result of this substitution of the ligands, an observable color change occurs, which is the basis for the present invention. Further, the formula as evidenced by <http://allergies.about.com> incorrectly illustrates fluorexon as including sodium (Na) which is a metal, however, this is not a metal co-ordinated complex, but a metal salt. (The correct illustration is indicated in the enclosed Aldrich chemical catalogue

at page 910, number 11,985-7.) This salt could act as a pH sensor but could not undergo a ligand exchange reaction with a spoilage metabolite as described by claim 1 of the present invention. Thus, the present invention is novel over Wallach. Accordingly, for the reasons set forth above, claim 1 is patentable over Wallach.

With regard to the rejection based on Frei et al, claim 1 was rejected based on the reason set forth in the Office Action that Frei et al teach Calcein, which is synonymous with fluorexon, as evidenced by <http://allergies.about.com>. The applicants' invention, as recited by claim 1 however, includes features which are neither disclosed nor suggested by Frei et al. Frei et al does not disclose a sensor for detecting food spoilage products within food packaging. Rather, Frei discloses a "developer" which is sprayed as a solution onto a thin layer chromatogram to detect the presence of pesticides. Frei et al. also does not disclose that the complex be immobilized in or on a substrate. Accordingly, for the reasons set forth above, claims 1 and 9 are patentable over Frei et al.

With regard to the rejection based on Kanakkanat, claims 1 and 9 were rejected based on the reason set forth in the Office Action that Kanakkanat teaches the present invention. The applicants' invention, as recited by claims 1 and 9, however, includes features which are neither disclosed nor suggested by Kanakkanat. Kanakkanat discloses different types of dyes which may change appearance via mechanisms including chemical reaction, illumination, heat or pressure. The vast majority of dyes discussed are not metal co-ordinated complexes. Although metal dithizonates of mercury (Hg), platinum (Pt), or palladium (Pd) are mentioned, no information on how they react to food spoilage products is given. The mechanism disclosed by Kanakkanat can be illustrated by referring to the attached page 1168 (number 38,370-8) from the Aldrich chemical catalogue, which shows Hg dithizonate (Pt and Pd analog are similar). It can be seen that the metal is co-ordinated to both sulfur and to nitrogen. As noted above with regard to Wallach, Pt and Pd form strong bonds with sulfur and nitrogen and are therefore not easily displaced. Thus, it would be highly unlikely that a sulphur, nitrogen or phosphorus containing food spoilage product would preferentially replace the diphenylthiocarbazone ligands. Accordingly, for the reasons set forth above, claims 1 and 9 are patentable over Kanakkanat.

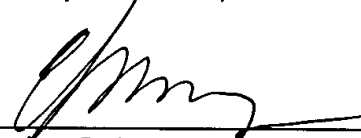
With regard to the rejection based on Honeybourne, claims 1 and 9 were rejected based on the reason set forth in the Office Action that Honeybourne teaches the claimed invention. The applicants' invention, as recited by claims 1 and 9, however, includes features which are neither disclosed nor suggested by Honeybourne. Honeybourne discloses the use of a

diamine compound which is reacted with a diacetyl compound. The product of this reaction is a different color than the diamine starting material. This color change is used to detect the presence of the diacetyl compound. The reaction is a condensation reaction which forms a fused ring structure. The diamine may be used in the form of a metal complex, but the color change is not a result of the substitution of one ligand by another, but rather through the formation of a new compound. No detectable component is released by the preferential binding of a gaseous substance to the metal of the complex. Thus, the present invention is novel over Honeybourne. Accordingly, for the reasons set forth above, claims 1 and 9 are patentable over Honeybourne.

Claims 2-7 and 10 include all of the features of independent claims 1 and 9, respectively, from which they depend, either directly or indirectly. Thus claims 2-7 and 10 are patentable over the art of record for the reasons set forth above.

In view of the amendments and arguments set forth above, the above-identified application is respectfully submitted to be in condition for allowance.

Respectfully submitted,



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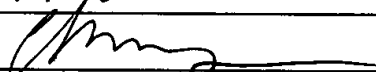
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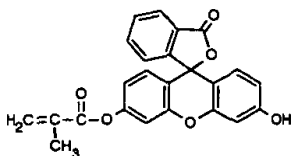
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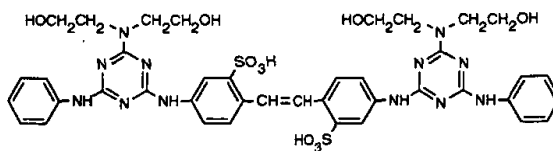
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■ Fluorescein ■

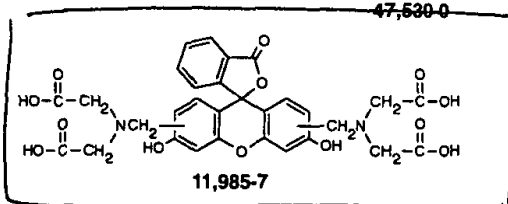
56,886-4	Fluorescein <i>o</i> -methacrylate (methacryloyloxyfluorescein) FW 400.38	250mg		
★	Fluorescent monomer.	1g	37.70	
47,530-0	Fluorescent Brightener 28, free acid [4404-43-7] FW 916.98 mp >300°	1g		
★	λ_{max} 349nm	5g	167.20	
	Dye content ~90%			
11,985-7	Fluorexon, indicator grade [1461-15-0] {bis[<i>N,N</i> -bis(carboxymethyl)-	2.5g	33.50	
★	aminomethyl]fluorescein} FW 622.55 λ_{max} 499nm FT-IR 1(2), 1015A	5g	83.55	
	R&S 1(2), 2797D UV-Vis 384 S: 22-24/25	25g	220.00	
	Indicator for Ca and Mg.			
31,893-0	Fluoride volumetric standard, solution in water [7681-49-4] NaF FW 41.99	100mL	13.50	
★	d 1.005 Fp none Fieser 1,1073 2,382 Merck Index 13,8691 R&S 1(3), 3303B	500mL	66.25	
	RTECS# WB0350000	6x500mL	108.70	
	This solution is prepared from A.C.S. reagent grade sodium fluoride in ASTM reagent grade I water.			
	1mL contains 1mg F ⁻			
38,778-9	Fluoride, polymer-supported [39339-85-0] (fluoride on Amberlyst® A-26)	10g	37.30	
	R&S 1(3), 3545C	50g	167.20	
	Employed in the synthesis of alkyl fluorides from alkyl chlorides, bromides, or sulfonates. <i>Synthesis</i> 1976, 472.			
12,834-1	Fluoroacetamide [640-19-7] FCH ₂ CONH ₂ FW 77.06 mp 107-109° Beil. 2,193	1g	13.50	
★	Merck Index 13,4193 FT-NMR 1(1), 1222A FT-IR 1(1), 751C Safety 2, 1691A	5g	36.80	
	R&S 1(1), 879A RTECS# AC1225000 RID/ADR 6.1/25a R: 24-28 S: 36/37-45			
29,973-1	2'-Fluoroacetanilide, 98% [399-31-5] CH ₃ CONHC ₆ H ₄ F FW 153.16 mp 77-79°	5g	5.90	
★	bp 140-142°/14mm Beil. 12,597 FT-NMR 1(2), 1361B Safety 2, 1691B R&S 1(2), 1995K	25g	14.90	
	R: 36/37/38 S: 26-37/39			
36,378-2	3'-Fluoroacetanilide, 98% [351-28-0] CH ₃ CONHC ₆ H ₄ F FW 153.16 mp 82-84°	5g	7.90	
★	Beil. 12(1), 297 FT-NMR 1(2), 1363A R&S 1(2), 1997D R: 36/37/38 S: 26-37/39	25g	30.20	
34,400-1	4'-Fluoroacetanilide, 98% [351-83-7] CH ₃ CONHC ₆ H ₄ F FW 153.16 mp 153-155°	25g	12.80	
★	Beil. 12,597 FT-NMR 1(2), 1364B R&S 1(2), 1997H RTECS# AE2977000 R: 36/37/38			
	S: 26-37/39			
	Fluoroacetic acid, sodium salt, see Sodium fluoroacetate			
37,851-8	4'-Fluoro-1'-acetonaphthone, 97% [316-68-7] FC ₁₀ H ₆ COCH ₃ FW 188.20	1g	29.20	
★	mp 33-35° bp 167°/17mm n _D 1.6080 d 1.203 Fp >230°F (110°C) Beil. 7(3), 1963			
	FT-NMR 1(2), 831B R&S 1(2), 1637D R: 36/37/38 S: 26-37/39			
11,546-0	Fluoroacetone, 98% [430-51-3] CH ₃ COCH ₂ F FW 76.07 bp 75° n _D 1.3700 d 1.054	1g	30.10	
★	Fp 45°F (7°C) FT-NMR 1(1), 648B FT-IR 1(1), 418B Safety 2, 1691D R&S 1(1), 455C	5g	96.50	
	RID/ADR 6.1/26a1. R: 11-26/27/28 S: 16-36-45			
25,744-3	Fluoroacetonitrile, 98% [503-20-8] FCH ₂ CN FW 59.04 bp 79-80° n _D 1.3330 d 1.061	1g	14.00	
	Fp 7°F (-13°C) Beil. 2(2), 185 FT-NMR 1(1), 1365B FT-IR 1(1), 847D Safety 2, 1692A			
	R&S 1(1), 995H RTECS# AM0175000 RID/ADR 3/11b R: 11-23/24/25-36/37/38			
	S: 16-26-27-45-36/37/39			
18,371-7	2'-Fluoroacetophenone, 97% [445-27-2] FC ₆ H ₄ COCH ₃ FW 138.14 bp 63°/9mm	1g	6.30	
★	n _D 1.5070 d 1.121 Fp 143°F (61°C) Beil. 7(3), 960 FT-NMR 1(2), 828A FT-IR 1(2), 23A	5g	20.20	
	Safety 2, 1692B R&S 1(2), 1635D R: 36/37/38 S: 26-36			
21,934-7	3'-Fluoroacetophenone, 99% [455-36-7] FC ₆ H ₄ COCH ₃ FW 138.14 bp 81°/9mm	5g	16.60	
★	n _D 1.5090 d 1.126 Fp 177°F (80°C) Beil. 7(3), 961 FT-NMR 1(2), 829B FT-IR 1(2), 24A			
	Safety 2, 1692C R&S 1(2), 1635I R: 36/37/38 S: 26-36			
F320-7	4'-Fluoroacetophenone, 99% [403-42-9] FC ₆ H ₄ COCH ₃ FW 138.14 bp 196°	25g	10.70	
★	n _D 1.5110 d 1.138 Fp 160°F (71°C) FT-NMR 1(2), 830C FT-IR 1(2), 25D Safety 2, 1692D	100g	27.60	
	R&S 1(2), 1637A R: 36/37/38 S: 26-36			



56,886-4



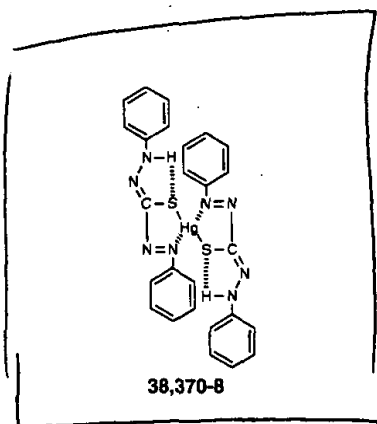
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11,985-7

Mercury di

- 38,370-8** Mercury(II) dithizonate [14783-59-6] [diphenylthiocarbazone, mercury(II) derivative] FW 711.24 R&S 1(2),3103J RID/ADR 6.1/52b R: 26/27/28-33-50/53 S: 13-28-36-45-60-61
Can be used in an introductory kinetics experiment for undergraduate laboratories. J. Chem. Ed. 1990, 67, 459.
- 33,931-8** Mercury(I) fluoride, tech. [13967-25-4] Hg₂F₂ FW 439.18 d 8.730
★ Merck Index 13,5796 R&S 1(3),3313A MOISTURE-SENSITIVE RID/ADR 6.1/52b S: 13-28-45-60-61
- 33,932-6** Mercury(II) fluoride, 97% [7783-39-3] HgF₂ FW 238.59 Merck Index 13,5904
★ R&S 1(3),3313B RID/ADR 6.1/52b R: 26/27/28-33-50/53 S: 13-28-45-60-61
- 54,851-0** Mercury(II) iodate, 99% [7783-32-6] Hg(IO₃)₂ FW 550.40 R: 26/27/28-33-50/53
★ S: 13-28-45-60-61
- 40,074-2** Mercury(I) iodide, 99% [15385-57-6] Hg₂I₂ FW 654.99 d 7.700
★ Merck Index 13,5922 RID/ADR 6.1/52b R: 33-26/27/28-50/53 S: 13-28-45-60-61
- 44,918-0** Mercury(II) iodide, anhydrous, beads, -10 mesh, 99.999% [7774-29-0] HgI₂
★ FW 454.40 mp 259° bp 354° d 6.094 Merck Index 13,5905 RTECS# OW5250000 RID/ADR 6.1/52b R: 26/27/28-33-50/53 S: 13-28-45-60-61
H₂O <100 ppm
(Packaged under argon in ampules)
- 20,378-5** Mercury(II) iodide, 99.999% [7774-29-0] HgI₂
★
- 22,109-0** Mercury(II) iodide, red, 99+%, A.C.S. reagent [7774-29-0] HgI₂
★ Assay ≥99.0% Hg⁺ ≤0.1%
Soluble Hg salts ≤0.05%
Solubility in KI soln.: to pass
- 23,041-3** Mercury(I) nitrate dihydrate, 97+%, A.C.S. reagent [14836-60-3] (mercurous ... nitrate) Hg₂(NO₃)₂ · 2H₂O FW 561.22 d 4.780 Fieser 5,430 6,360 Safety 2,2218C R&S 1(3),3415A RTECS# OW8000000 RID/ADR 6.1/52b R: 26/27/28-33-50/53 S: 13-28-45-60-61
Assay ≥97.0% Fe ≤0.001%
Insolubles ≤0.005% Hg²⁺ ≤0.5%
Reduction residue ≤0.01% SO₄²⁻ ≤0.005%
Cl⁻ ≤0.005%
- 51,695-3** Mercury(II) nitrate monohydrate, ReagentPlus™, 99.99+%, [7783-34-8]
★ Hg(NO₃)₂ · H₂O FW 342.61 mp 79° d 4.300 RTECS# OW8225000 R: 26/27/28-33-50/53 S: 13-28-45-60-61
Meets A.C.S. reagent specifications, see 23,042-1. Total metallic impurities <100 ppm
- 23,042-1** Mercury(II) nitrate monohydrate, 98+%, A.C.S. reagent [7783-34-8]
★ Hg(NO₃)₂ · H₂O
Assay ≥98.0% Fe ≤0.001%
Reducing residue ≤0.01% Hg⁺ ≤0.2%
Cl⁻ ≤0.002% SO₄²⁻ ≤0.002%
- 31,905-8** Mercury(II) nitrate volumetric standard, 0.141N solution in water [7783-34-8] ...
★ Hg(NO₃)₂ FW 324.60 d 1.025 Fp none Fieser 3,197 10,254 11,317 Merck Index 13,5777 R&S 1(3),3415B RTECS# OW8225000 RID/ADR 8/17c
R: 8-33-34-23/24/25 S: 17-26-45-36/37/39
This solution is prepared from A.C.S. reagent grade mercury(II) nitrate monohydrate and nitric acid in ASTM reagent grade I water, and is standardized potentiometrically traceable to NIST reference material.
1mL corresponds to 5mg Cl⁻



- 16-6** Mercury(II) nitrate
★ Hg(NO₃)₂ FW 324.6
Index 13,5777 R&S 1
R: 8-34-40-26/27/28
This solution is prepared
and nitric acid in AST
traceable to NIST ref
Concentration range
- 379-3** Mercury(II) oxide, (Fieser 1,655 2,267 4
★ Safety 2,2219B R&S
R: 26/27/28-33-50/53
- 335-7** Mercury(II) oxide, (Assay ≥99.0%
★ Fe ≤0.005%
N compounds ≤0.0
SO₄²⁻ ≤0.015%
- 2308-2** Mercury(II) oxide, (Assay ≥99.0%
★ Fe ≤0.003%
N compounds ≤0.0
SO₄²⁻ ≤0.01%
- 2336-7** Mercury(II) oxide, (Assay ≥99.0%
★ Fe ≤0.003%
N compounds ≤0.0
SO₄²⁻ ≤0.01%
- 3365-6** Mercury(II) perchlorate, 97+%, A.C.S. reagent [7783-34-8]
★ R: 26/27/28-33-50/53
- 4372-6** Mercury(II) perchlorate, 97+%, A.C.S. reagent [7783-34-8]
★ FW 372.10 mp 64° F
- 10931-1** Mercury(II) perchlorate, 97+%, A.C.S. reagent [7783-34-8]
★ Fieser 5,428 R&S 1
S: 17-26-27-45-36/37
x-3-5. Hg 42-45%
- 10071-8** Mercury(II) selenide, 97+%, A.C.S. reagent [7783-34-8]
★ R: 26/27/28-33-50/53
- 4289-5** Mercury(II) sulfate, 97+%, A.C.S. reagent [7783-34-8]
★ Merck Index 13,5924
S: 13-28-45-60-61
- 20009-3** Mercury(II) sulfate, 97+%, A.C.S. reagent [7783-34-8]
★ Fieser 1,658 15,200
RTECS# OX0500000
Assay ≥98.0%
Reduction residue ≤0.003%
Cl⁻ ≤0.003%
- 40073-4** Mercury(II) sulfide, 97+%, A.C.S. reagent [7783-34-8]
★ R&S 1(3),3299A R7
S: 13-28-45-60-61
- 24356-6** Mercury(II) sulfide, 97+%, A.C.S. reagent [7783-34-8]
★
- 40072-6** Mercury(II) telluride, 97+%, A.C.S. reagent [7783-34-8]
★ RID/ADR 6.1/52b R:
- 23368-4** Mercury(II) tetrathionate, 97+%, A.C.S. reagent [7783-34-8]
★ Safety 2,2220A R&S
S: 22-26-45-36/37/39
High-purity magnetic
- 48182-3** Mercury(II) thiocyanate, 97+%, A.C.S. reagent [7783-34-8]
★ d 3.710 Merck Index
RID/ADR 6.1/52b R:
- 20813-2** Mercury(II) thiocyanate, 97+%, A.C.S. reagent [7783-34-8]
★